



RIO Country Report

Romania 2014

2015



European Commission

Joint Research Centre

Institute for Prospective Technological Studies

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JRC 96475

EUR 27303 EN

ISBN 978-92-79-48959-4 (PDF)

ISSN 1831-9424 (online)

doi:10.2791/925233

Luxembourg: Publications Office of the European Union, 2015

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Abstract

The report offers an analysis of the R&I system in Romania for 2014, including relevant policies and funding, with particular focus on topics critical for two EU policies: the European Research Area and the Innovation Union. The report was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites etc. The report identifies the structural challenges of the Romanian research and innovation system and assesses the match between the national priorities and those challenges, highlighting the latest policy developments, their dynamics and impact in the overall national context.

Acknowledgments

The report draft has benefited from comments and suggestions of Dragoş Pîslaru from GEA Strategy & Consulting S.A. and of Jana Zifčiaková from JRC-IPTS. The contributions and comments from DG RTD and JRC-IPTS are also gratefully acknowledged.

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Executive summary

This report was prepared according to set guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites, etc. The quantitative and qualitative data is, whenever possible, comparable across all EU Member State reports.

While Romania is a relatively large country (20m inhabitants), its RDI system is undersized: the number of researchers per population is four times lower than the EU average. Almost 80% of researchers are in the public sector, relatively equally distributed among the national R&D institutes, the institutes of the Romanian Academy and the branch academies, and universities.

As the country is not yet an innovation-based economy or even in transition towards an innovation-based economy (WEF 2014), it is not surprising that the private research organisations are very rare, while only a few companies report R&D activities. However, over the last years there have been signs of more vibrant innovation-oriented activities, visible in the formation of hubs, especially in ICT.

In terms of governance, the system is a centralised one, the Ministry of Education and Scientific Research (MESR) being in charge of the elaboration of the national RDI Strategy. The MESR has only limited power in influencing the policies beyond the resources it controls directly, as the interministerial council in charge of a broader coordination of RDI policies has had not recorded any activity so far.

Continuous political battles over the national law of education or the control of the main financing agency maintained a climate of uncertainty in the system. Combined with a promised but perpetually delayed increase in the public R&D expenditures, the uncertainty resulted in a massive brain-drain and an underuse of the relatively good research infrastructure.

Even if Romania has registered economic growth rates of around 3% starting 2013, and renewed its commitment to reach gradually 1% of GDP public R&D expenditures, the R&D allocation remained below 0.25% of GDP. The pressure of the research community and the civil society to respect this strategic commitment is limited. This is also the case for the education sector (3% instead of 6%).

The relatively low allocation of structural funds (SF) for RDI also shows the low political interest in this field (approx. €1b for 2014-2020, representing 15% of the public R&D required to reach 1% of GDP in 2020), even though the absorption rate for R&D funds was 100%, compared to less than 40% for the rest of the fields.

The year 2014 and the beginning of the year 2015 are situated between two programming periods. The new National RDI Strategy 2014-2020, elaborated as a result of a large participatory foresight, is a comprehensive one, with a stronger orientation towards innovation. As part of ex-ante conditionality, Romania adopted a set of additional strategies which include a broad range of innovation-related objectives and measures (e.g., The National Strategy for Competitiveness 2014-2020, The Governmental Strategy for the SME sector and business environment. Horizon 2020), but their resources and the implementation plans remain unclear.

In 2013, institutional funding represented 59% of R&D expenditures from governmental resources. The recipients of the institutional funding are the national R&D institutes (via the programme NUCLEU) and the institutes of the Romanian Academy (via the research

programme of the Romanian Academy). Institutional funding is not fully competitive: the evaluation of institutes carried out so far does not clearly set them apart in terms of quality, so the correlation with the level of financing remains weak. Universities do not receive institutional funding for RDI and their RDI activity is only assessed as proxy for the quality of education services.

The main competitive programmes are the national RDI Plan 2007-2013 (the most affected by the budgetary cuts, still in place as of May 2015) and the RDI structural funds (mostly allocated by the MESR).

BERD is even lower than public expenditures, reaching only 0.12% of GDP in 2013 (decreasing from 0.19% in 2012). The situation can be explicable by the low high-tech intensiveness of the economy and the limited number of multinationals which establish R&D centres in Romania, but also by the low interest of companies in reporting R&D expenditures.

The RDI Strategy 2014-2020 sets the ambitious target of 1% BERD by 2020, with the main triggers being public expenditures, a better focus of these expenditures in smart specialisation areas, and the tax deduction for R&D expenditures. Most of these expectations are already below schedule: the allocation of public R&D expenditures for 2015 is less than half of the value established in the adopted national strategy, and the main implementation instrument (i.e., the National RDI Plan 2014-2020) has not been yet adopted (by May 2015).

In what regards smart specialisation, a large foresight process (www.cdi2020.ro) was carried out as part of the elaboration of the National Strategy 2014-2020. The process was based on data analytics and supported by a wide participation of stakeholders (200 panellists and 4000 online respondents), and it provided a set of four smart specialisations: *Bioeconomy*, which is rooted mainly in the huge agriculture potential; *ICT*, which is clearly the most dynamic sector in Romania; *Energy and environment*, in connection with the challenges of energy efficiency and water resources, and of substitution of critical materials; and *Eco-technologies*, which focuses on new-generation vehicles, equipment, technical systems for the generation of bioresources, and depolluting and waste reuse technologies. The specialisations resulting from consultations were extended by political decision and included space and security, energy production, and the entire spectrum of new materials. While this additional list may have its possible arguments, it attenuates the focus of the specialisations and reduces the chances of reaching critical mass point for advancing in the global value chains.

The regional smart specialisation strategies in all of the 8 regions should be elaborated by the end of 2015, but as the actual regionalisation process is still pending in Romania, the spectrum of instruments these strategies can use remains limited.

The main transnational cooperation in which Romania is involved is related to the Extreme Light Infrastructure – Nuclear Physics (ELI-NP), a pan-European infrastructure which will be built using structural funds in Magurele, near Bucharest. Access to the ELI-NP will be granted for most of the eligible time based on the evaluation of the scientific cases by the international scientific board. In addition to the €300m for the laser project, a plan to build a 1bn euro science park in 2017 (also using structural funds) is already part of the Ilfov County Council's strategy for promoting entrepreneurship and developing research.

Romania has a relatively large number of research infrastructures – investments that were mostly supported by structural funds. In order to increase the national and international

access to these infrastructures, an online booking platform for research infrastructure services (www.erris.ro) will be launched in 2015.

Except for the access to research infrastructures, Romania is not enough attractive for researchers. The underfinancing and uncertainty in the RDI system have resulted in a massive brain-drain, while the project financing the targeting of foreign and diaspora researchers associated to Romanian research organisations has had only limited resources.

Technological entrepreneurship is only now emerging. The culture of entrepreneurship in Romania is, in general, not widespread, and the public infrastructure for technology transfer and incubation is mostly non-functional, as assessed by the authorities themselves. However, private initiatives have been more active in the last years and an important tax deduction for business angels was introduced in 2015, which may accelerate the dynamics of technological entrepreneurship.

For the moment, the RDI system in Romania has a higher productivity than the EU average in terms of publications per researcher, which is mostly driven by the requirements of the academic career in universities. The EPO patenting is almost absent (3% of the EU average per GDP in PPP), while there are only few innovation-driven companies.

Considering the situation outlined above, Romania first faces the challenge of ensuring a credible path for gradually increasing the public R&D expenditures. To increase the orientation of the business sector towards innovation, the tax deduction represents an important step, but a more complex policy mix is required. The business sector also needs to find reliable partners in the public research organisations. Indeed, the whole public R&D system needs restructuring in order to improve its correlation with the structure of the economy and the relevance of its outputs, not only for the business sector, but also for policy-making. The innovation infrastructure needs to build on the actual practices in the business sector.

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1. Overview of the R&I system

1.1 Romania in the European RDI landscape

Despite its strong public research base and a certain degree of awareness of the importance and role of the R&I sector, Romania is lagging behind most of its European peers. With a disjointed innovation ecosystem, caused by misalignment of incentives, lack of trust and self-sufficiency, Romania finds itself in a paradoxical situation, mixing a general lack of results with global excellence in both fundamental research (e.g. Mathematics, Physics) and entrepreneurial technological innovation (e.g. internet security). While the potential for catching-up is high, Romania faces the full challenge of brain drain, with the danger of not being able to create the critical mass of elite researchers needed for boosting its R&I ecosystem.

Romania has one of the lowest GDPs in Europe: in 2013, GDP per capita in PPP was 54% of EU28 average (Eurostat). Further discrepancies can be found between the eight regions, with Bucharest registering more than double the GDP per capita compared with the second-best region (i.e., West Region) and four times compared with the region with the lowest level (i.e., North East) (2010, NIS data).

The economic growth for 2013 was 3.5% (Eurostat), and it is estimated at 2.6% for 2014 and 2.5% for 2015 (Autumn Forecast of the National Commission for Prognosis 2014).

Romania is the 9th largest country in terms of population in the EU: with 20m inhabitants in 2013 it has 4% of the EU's total population (Eurostat). It is also the country with the largest share of rural population in Europe: in 2012, 43% of the population lived in thinly-populated areas, compared with 28% EU average (Eurostat).

The structure of the economy is considerably different from the EU average: while employment in manufacturing is slightly above the EU average (19% compared to 16%), agriculture represents 26% of employment (compared to 4% EU average) (Eurostat data 2013). Of the 8.365m jobs in Romania just over 4m jobs are remunerated. The very high level of self-employment (2.1m, 25% of all jobs) is associated with subsistence agriculture and a lack of alternatives rather than with entrepreneurship. A further 1.4m (20% of all jobs) is unremunerated family labour, a category that barely exists in the more developed economies of the EU (Partnership Agreement, p.11).

The research, development and innovation (RDI) system is small compared to the country's population: the number of researchers (FTE) per population is four times less than the EU average. In terms of financing, the RDI system continues to be "in a silent crisis" (World Bank, 2010): GERD was 0.39% in 2013, down from 0.48% in 2012. Most of the reduction was caused by the diminished contribution of business (from 0.19% in 2012 to 0.12% 2013), but also by a further reduction of public expenditures (from 0.29% in 2012 to 0.27% 2013). Measured in euro, GERD per capita is 19 times smaller than the EU average. At this level, one would expect the RDI system to fail being a driver of economic development.

The official target of 1% public R&D expenditure (complemented by 2% private R&D expenditure) was first set in 2006 and was used as a basis for the programming period 2007-2013, but the reality showed an average annual allocation for the National Plan three times smaller. Romania has again reaffirmed the objective of 1% public (this time

with an additional 1% from private sources) for 2020, and these figures were considered as the basis for the National RDI Strategy 2014-2020 and its main implementation instruments. However, only several months after the adoption of this strategy in 2014, the budgetary allocation for 2015 is 2.17 times lower than the iterated objective for the year. In reaction to this discrepancy, civil society representatives raised the issue of ministerial responsibility¹.

1.2 Main features of the R&I system

Romania has a:

- *Centralised RDI system.* The country is divided into eight ‘development regions’, however, in administrative terms their decision power is very limited. A process of regionalisation has been announced, but both the public opinion and the experts are divided about the best approach to this matter. Each region has an Agency for Regional Development (ARD)² which elaborates a Regional Development Plan, financially supported mainly by the structural funds allocated via the Regional Operational Programme. For the period 2014-2020, the RDI funds under the Regional Operational Programme represent only 17% of RDI structural funds, and they will be predominantly directed towards innovation and the technology transfer infrastructure.
- *A public RDI system concentrated in national institutes.* The main research organisations are the national R&D institutes (former sectoral institutes under the communist regime), most of which are now subordinated to the Ministry of Education and Scientific Research (MESR), the institutes of the Romanian Academy and of the branch academies. They receive institutional funding, highly correlated with the number of researchers, following a rather inertial financing model. Universities are new players, respectable in terms of scientific publication but with very weak connections with industry. The R&D activities are rather occasional, related to the oscillating project funding and/or the publishing efforts in relation to the academic career³.
- *Private research almost absent.* In a chronically underfinanced system, the survivors are usually the organisations receiving institutional public funding.
- *Very low business interest in R&D.* BERD is only a quarter of GERD, and only one third of the R&D business expenditures are devoted to activities performed by universities or research institutes.
- *Good research infrastructure and relatively large number of PhDs,* both underused resources given the low project funding.
- *Massive brain drain,* especially of top young researchers, affecting the capacity of the system to replenish and reach critical mass.

¹ <http://www.romaniacurata.ro/ad-astra-bugetul-pentru-cercetare-este-prea-mic-si-incalca-legea/>

² The role of each Regional Development Agency is to contribute to sustainable and equitable development by removing disparities and imbalances between areas of the region, for the benefit of its inhabitants. Established by Law 151/1998, the Regional Development Agencies operates under Law 315/2004 on regional development in Romania. Each Agency is coordinated by the Regional Development Council, which brings together the presidents of county councils and representatives of municipalities, towns and villages in each county

³ In the statistics the number of researchers from universities is estimated simply as equivalent of 25% of academic staff.

- *Emerging state-of-the-art private sector innovation* especially based on the strong domestic ITC sector and on its engineering excellence.

1.3 Structure of the national research and innovation system and its governance

Inter-ministerial coordination is currently absent

The innovation policies have no de facto inter-ministerial coordination, as the responsible body at governmental level (i.e., The National Council for Science and Technology Policy – NCSTP) has remained inactive since its creation.

In the governance chapter the NS 2014-2020 provides for the creation of *The National Council for Science, Technology and Innovation Policy* (NCSTIP)⁴ with the aim of replacing the NCSTP. Having as members several ministers, the NCSTIP's mission is to ensure the coordination and correlation of RDI policies with the sectorial and regional ones. The newly founded *RDI Policy-support Unit* of the MESR would elaborate the annual reports for NCSTIP.

Advisory councils for the Ministry of Education and Scientific Research are only partially in place

According to the NS 2014-2020 the new consulting bodies for RDI are:

- *The Advisory Board for Research, Development and Innovation* (ABRDI), which is “the main consulting body of the MESR”. Its activity is related to applied research, technological development, innovation, technological transfer and scientific international cooperation.
- *The National Council for Scientific Research* (NCSR) is active in basic and frontier research and the development of human resources in research. The members of the council were appointed on the 9th of January 2015 after an extended hiatus.

Public funding allocation is based on annual budgeting

Until the new Strategy is implemented⁵, the credit-granting institutions are the following:

- *The Ministry of Education and Scientific Research – MESR* and its agencies
 - *The Executive Agency for Higher Education, Research, Development and Innovation Funding* (UEFISCDI), subordinated to the MESR, is the implementing agency for the National RDI Plan 2007-2013 (budget €131m in 2013), a set of project-based funding schemes with a structure and procedures very similar to FP7 (i.e., the programmes Ideas, Human Resources, Partnerships, Innovation, Capacities), open for all the RDI actors.
 - MESR implements the programme *Nucleu*, an institutional funding instrument for the National R&D Institutes (budget €70.5m in 2013)
 - *The Intermediary Body for RDI*, coordinated by MESR, implements the operational programme for RDI structural funds 2007-2013 (with an average annual budget of approx. €120m)

⁴ NCSTIP has not been made active by end of February 2015.

⁵ The National RDI Plan 2014-2020 has not available by end of February 2015. The situation creates uncertainty in terms of programmes and even in terms of institutional development.

- *The Romanian Academy* – which has its own chapter in the national budget (€100.7m in 2013) – allocates the budget for its research institutes.
- *Different ministries (Ministry of Economy, Ministry of Agriculture, MESR)* manage their separate “sectorial RDI plans” (estimated budget in 2013 below €10m).

The Romanian university system (including approx. 100 accredited universities, about half private) is quite homogenous in terms of organisational structures and learning experience. They currently offer “Bologna-type bachelors, masters, and doctoral programs, while distance or “open” education programs are few in number and questionable in quality”. (Andreescu et al 2014) The homogeneity of the provided services and the absence of a strong reputation mechanism (as ranking is practically suspended) is reflected in the undifferentiated and low tuition fees (around 500-700 Euros per year in both the private and state universities).

“The poor standing of Romanian higher education institutions (HEIs) in international university rankings (no university has yet gained entry into the top 500, much less the top 200, of the best-known international rankings) is commonly cited as a sign of the system’s weakness and of its low research productivity. It may have also contributed to the fact that the public opinion – executives included (WEF, 2013)⁶ – has become increasingly unfavourable or indifferent towards universities, thus hampering their efforts to recruit the very best high school graduates, many of whom now go to study abroad.” (Andreescu et al 2014) The limited top scientific results of universities need to be considered in the context of the very inadequate public R&D resources at national level and of the absence of institutional R&D financing for universities.

Romania had no company in the top 1000 EU R&D performers in 2012

Several multinationals have created R&D centres in Romania, such as: *Renault Technologie Roumanie* with 3,200 engineers, *Honeywell Romania* (Automation and Control Solutions, and Transportation Systems) with 20 R&D engineers/scientists, *Infineon Technologies*: (semiconductors) with 300 employees and *Continental Automotive* with three R&D centres (Source: Kaminski 2011, p12 and Dachs et al 2014, p129).

According to the European Alpbach Forum, Romania is in the top European countries in terms of brain drain: with 26,296 specialists with higher education working in other Western countries since 2003, it positions itself on the third place (after Poland and Germany). The main destinations are UK, Italy, Germany and Belgium.⁷

⁶ The World Economic Forum in its *Global Competitiveness Report* ranks Romania 108 out of 144 countries in terms of the perception of the executives regarding “how well does the educational system meets the needs of a competitive economy” ranked 108 out of 144 countries (WEF 2013, p442). According to a survey commissioned by the Romanian Ministry of Education and Scientific Research, 45% of the students, 41% of the parents, and 34% of the teachers stated they believed corruption is present “to a large degree” and “to a very large degree” in Romanian universities (UTM, 2013, 45).

⁷ <http://www.alpbach.org/alpbuzz/2014/08/26/where-the-european-brains-move/>

Main changes in 2009

After several years of increasing its public R&D expenditure to meet the official 1% target, the Romanian Government decided to respond to the economic crisis by reducing the R&D expenditures financed by Government from 0.4% of GDP in 2009 to 0.25 % in 2008 and stay at this level ever since. Most of the reduction affected the implementation of the National RDI Plan 2007-2013.

Main Changes in 2010

UEFISCDI was created by merging three financing agencies responsible for the implementation of the National RDI Plan 2007-2013. Following this decision the administrative costs dropped from 4% to 2% and international peer-review has become a norm for project financing under the National RDI Plan 2007-2013.

Main changes in 2011

The decision for financial allocation for ELI-NP. The project represents a huge opportunity for Romania. At the same time, the decision was not supported by an increase in the allocation of more structural funds for R&D, thus reducing the room for project funding.

The Law on National Education no. 15 January 2011 and the Government Decision no. 789/2011 Methodology for classification of universities and ranking of study programmes restricted the right of organising doctoral studies only to "research universities", but failed in connecting the classification and rankings to clear financing lines.

Main changes in 2012

The Government Ordinance 96/22.12.2012 regarding the reorganisation of the central public administration. According to the Government Ordinance of 22.12.2012 the Ministry of Education, Research, Youth and Sport was reorganised by splitting it into the Ministry of National Education (MNE) and the Ministry of Youth and Sport, while the National Authority for Scientific Research (NASR) was dissolved, with all attributes taken over by the new MNE (currently, Ministry of Education and Scientific Research). Furthermore, the Government Ordinance established the position of Delegate Minister for Higher Education, Scientific Research and Technological development within the MNE. Additionally, the different research institutes formerly subordinated to various other ministries were subordinated to the new Ministry of National Education.

Main Changes in 2013

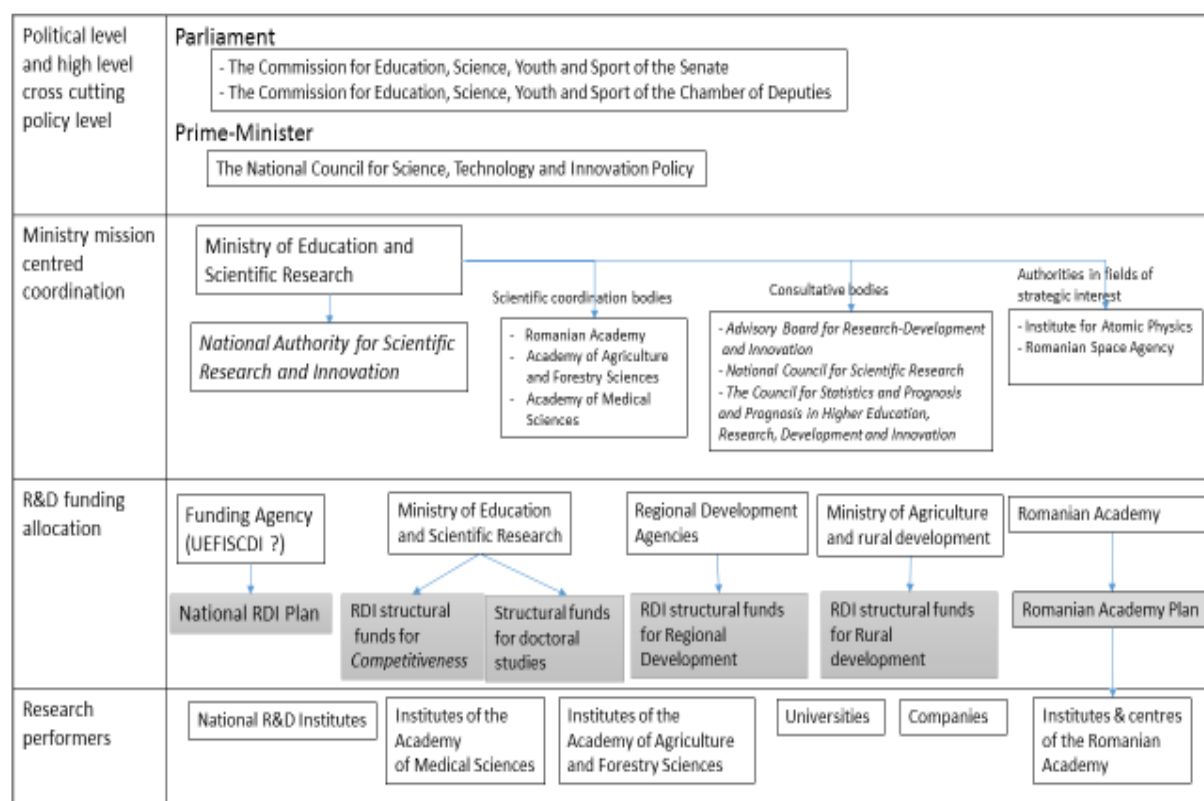
Main Changes in 2014

The Emergency Ordinance no. 49/2014 brings new changes to the 2011 Law on National Education. Under the amended Law, the Ministry of National Education may raise up to 10% the matriculation limits imposed on academic programs by the Romanian Agency for Quality Assurance in Higher Education; private universities may be also established by private individuals (rather than, as previously, by foundations only); universities may establish part-time doctoral study programs (rather than full-attendance programs exclusively); universities may establish pre-tertiary educational institutions; private universities may decide on their organizational structures, the powers of their officers, and the length of the latter's terms.

Adoption of the National RDI Strategy 2014-2020 by Governmental Decision. The new strategy has ambitious targets, includes smart specialisations and priorities of national interest, and a large spectrum of instruments and policies able to support the development of an innovation ecosystem. However, the strategy remains a formal commitment as the budgetary commitment has already been broken and the main implementation instrument has not been adopted.

Since December 2014 the Government has a new structure approved by Parliamentary Decision 44/2014. As the new government structure is meant to reduce the number of the ministries, it eliminates the delegate ministers, among which the delegate minister for Higher Education, Scientific Research and Technological Development. The new name of the ministry is the Ministry of Education and Scientific Research, and the RDI component is the National Authority for Scientific Research and Innovation.

Figure 1: The Structure of RDI governance 2014-2020



2. Recent Developments in Research and Innovation Policy and systems

2.1 National economic and political context

Romania substantially improved its ranking in the Global Competitiveness Index (GCI) from 78 in 2013-2014 to 56 in 2014-2015. Still, the country remains an efficiency-based economy, while most of the EU countries are either innovation-based or in transition towards an innovation-based economy. Out of the 12 GCI pillars, Romania has its strengths in macroeconomic environment, market size and technological readiness, while the weakest point is innovation. The most problematic factors for doing business are: access to financing, tax rates, inadequate supply of infrastructure and corruption.

The Foreign Direct Investments registered a slight recovery after the drop in 2011 (€1.7b), to €2.5b in 2012 and €2.7b in 2013. FDIs remain concentrated in Bucuresti-Ilfov (61.4% in 2013). The main FDI sectors in 2013 were: manufacturing (31%), financial intermediation (14%), trade (11%) and energy (11%). The most prominent branches of manufacturing are: petrochemical (19%), transport vehicles and equipment (18%), metallurgy (13%) and food, beverages and tobacco (12%). (*FDI in Romania 2013*, National Bank of Romania).

Though Romania formally meets the Maastricht criteria, the adoption of the euro has been postponed until 2019. The reasons are connected to the need for economic convergence. The accession of Romania to the Schengen has been further delayed. According to the Prime Minister, the Schengen accession is no longer a key negotiation point.

The absorption rate for structural funds allocated for the period 2007-2013 remains very low: only 39% in 10 October 2014 (Source: Ministry of European Funds⁸). A special problem in absorption relates to transport infrastructure, where numerous projects are delayed or cancelled (problem usually associated with accusations of corruption).⁹

The Romanian government adopted on 26 June 2014 the Emergency Ordinance no. 49/2014, bringing about substantial changes to the 2011 Law on National Education. Under the amended Law, the Ministry of Education and Scientific Research may now raise by 10% the matriculation limits imposed on academic programs by the Romanian Agency for Quality Assurance in Higher Education¹⁰; private universities may also be established by private individuals (rather than, as previously, by foundations only); universities may establish part-time doctoral study programs (rather than full-attendance programs exclusively); universities are allowed to found, by themselves or in cooperation with other legal persons, primary or secondary educational institutions; private universities may decide on their organisational structures, the powers of their officers, and the length of the latter's terms. These changes enjoyed the support of the National Federation of Unions "Alma Mater" and the Federation of Educational Unions "Spiru Haret". They were, however, strongly criticised by the opposition, two former ministers of education, and the rector of

⁸ <http://www.fonduri-ue.ro/stadiul-absorbtiei>

⁹ <http://www.hotnews.ro/stiri-esential-17493789-mari-probleme-transporturi-dezastru-absorbtia-fondurilor-europene-investitiile-fost-taiate-puternic-iar-realizarea-intregii-autostrazi-sibiu-pitesti-din-nou-incerta.htm>

¹⁰ Previously, enrolment in a specific academic program was effectively capped by the accreditation procedures carried out by the Romanian Agency for Quality Assurance in Higher Education, which set a maximum matriculation threshold. Now this threshold may be raised by 10% by the Ministry of Education.

one of Romania's leading higher education (HE) institutions, the Babes-Bolyai University in Cluj.

Hiring in the public sector was halted for four years. In 2009, the Government decided that any hiring in the budgetary sector may be made only provided that 7 other persons leave for every new hire. It is only in July 2014 that the Government decided on a 1:1 replacement scheme, but only after removing all vacant places (except some in strategic sectors such as defence)¹¹.

2.2 National R&I strategies and policies

R&I policies For more than two decades RDI activities have not have been perceived at the political level as a means for increasing economic competitiveness, but rather as a matter of intellectual reputation. A vicious circle was created: the chronically underfinanced RDI system does not reach the critical mass for technology development, while the low economic impact further restrains the allocation of public funds.

The year 2014 was characterised by institutional fragility and uncertainty in the R&D field:

- a) The National Council for Scientific Research (NCSR) had no members from April 2013 (when they resigned in block in protest over cuts to the R&D budget) to February 2015.
- b) The Government Ordinance which created the main R&I financing agency (UEFISCDI) has been a subject of dispute. The GO 74/2010 created *The Executive Agency for Higher Education, Research, Development and Innovation Funding* (UEFISCDI) by unification of three funding agencies, each of them dealing with different programmes of the National Plan for Research, Development and Innovation 2007-2013.

On 18 February 2014, four years after the GO 74's adoption – a period with a considerable improvement in the transparency of programmes' procedures, with the introduction of international peer review, and reduction of operational costs from 4% to 2% – the parliamentary commission for education in the Senate approved the law rejecting GO 74, thus implicitly replacing UEFISCDI by the three previous financing agencies. This also generated a legislative void in certain aspects related to the role UEFISCDI played according to more recent legislation. The law met with protests from civil society representatives.

A document of the Romanian Academic Society (RAS) talks about "the risk of feudalisation of research funds in an election year", suggesting that the decision serves the interests of the former minister of education Ecaterina Andronescu, the delegate HE minister Mihnea Costoiu and the Bucharest Politehnica University (where both had served as rectors), which managed one of the former three financing agencies, responsible for the programme Innovation¹².

¹¹ <http://cursdeguvernare.ro/institutiile-publice-angajari-%E2%80%9D1-la-1%E2%80%9D-in-sectorul-public.html>

¹² According to UEFISCDI general director Adrian Curaj, in the period 2007-2010, out of 298 projects [in the programme "Innovation"], Politehnica Bucharest coordinated 186. The next institution in ranking was a company with 21 projects, followed by Politehnica Iasi with 19 projects. By comparison, in the period 2011-2014, out of 277 projects, Politehnica had only 23" (Adevarul, April 1st 2014).

On 18 March 2014 the law cancelling the GO was sent for re-examination by president Traian Basescu¹³, but, on 26 March 2014, the Commission for Education of the Chamber of Deputies rejected the request¹⁴. As a reaction, the Coalition for a Clean Romania sent a protest to the Prime Minister on April 7th, a protest supported by Ad-Astra (an NGO dedicated to the scientific community). The resolution of this conflict is still pending, but the RDI Strategy 2014-2020 adopted in October 2014 does not mention at all UEFISCDI as a funding agency or as playing any other role.

The National Strategy for Research, Development and Innovation 2014-2020 (NS 2014-2020) was adopted on 21 October 2014. Its elaboration was outsourced by the Ministry of National Education to a consortium headed by 11 main partners supported by an additional 141 associated partners. The project (www.cdi2020.ro) carried out in 2013 deployed a full-fledged, evidence-based, smart specialisation-aware foresight exercise, the result being not only the technical version of the National Strategy, but also the main implementation instruments, namely, the National RDI Plan 2014-2020 and the RDI Operational Programme for the same period. The adopted version of the strategy is similar to the one resulting from the consultations, except for two areas: the list of priorities which was broadened and the governance structure proposal, which was changed.

The Vision for 2020 included in the National Strategy envisages an innovation ecosystem where research and development support the advancement in global value chains. In this environment, excellence and an entrepreneurial spirit mobilise a critical mass of actors; companies become key actors of innovation; the R&D sector is developed around strategic fields and is internationally integrated; and Romania is placed next to major European or global initiatives, either through co-participation or by assuming a leading role (in cases such as ELI-NP or Danubius-RI).

NS 2020 is to be implemented by the following programmes (in addition to other policies, such as the implementation of the 50% R&D tax deduction):

- The *National RDI Plan 2014-2020* (NP3)
- The Operational Programme *Competitiveness* – objective “Capacity building for the RDI system 2014-2020” (OPC-RDI)
- The Operational Programme *Human capital* – the component “Education and training”
- The *Regional* Operational Programme – the component “Competitiveness and business environment for SMEs”
- The Operational Programme *Rural development* – the component “Investment in agriculture and rural development”
- *The Sectorial Plans* of different ministries
- The Research Plan of the Romanian Academy and its institutes
- Other sectorial policies (coordinated by NCSTIP, not specified in the Strategy).

¹³ The motivation provided by the president states that “the GO has been elaborated in view of increasing the efficiency of material, financial and human resources” and that there is a risk of legislative void.

¹⁴ The motivation report provided on April 2nd states that “the GO results in the centralization of the management of research programmes” and “UEFISCDI cannot be at the same time evaluator and implementer of research programmes” (despite RAS’s previous explicit mention that UEFISCDI is not implementing research projects).

NP3 will be the main implementation instrument of the Strategy and the responsibility for its management and execution belongs to MESR, which “may outsource management to financing agencies or other service providers”. Hence, UEFISCDI, the agency implementing the previous plan has now a very uncertain position as a possible outsource, with the risk of breaking the learning process of professional programme management in Romania.

Draft forms of NP3 and of the RDI component of The Operational Programme *Competitiveness* have been elaborated together with the Strategy, as part of the same large project in 2013. While the OP is close to adoption, the NP3 proposal has been postponed and a substantially changed version has been subject to different consultations.

As part of ex-ante conditionality, Romania has adopted a set of additional strategies which provide a broad range of research and innovation objectives. It is the case of *The National Strategy for Competitiveness 2014-2020*, which intends to be an umbrella strategy and *The Governmental Strategy for the SME sector and business environment Horizon 2020*, which has very ambitious objectives in supporting innovation in SMEs (see chapter 4.1). However, these strategies are not followed by clear action plans with dedicated resources and the very commitment for their implementation seems to fluctuate with the change in the coordination of the responsible ministries. Often these strategies are reiterated as support for very specific programmes, some of them integrating good international practices, which however remain very restricted in scope compared with the strategies themselves.

2.3 National Reform Programmes 2013 and 2014

The National Reform Programme 2014 (NRP, Romanian Government 2014)¹⁵ represents “the framework for the definition of the reforms and priorities for the economic development of Romania for the period July 2014-June 2015, in conformity with the Strategy Europe 2020 and the European Semester 2014”.

In the evaluation of the recent progress (year 2013), the NRP does not refer to the targets of the National RDI Strategy 2007-2013 in terms of public expenditures (four times lower than the 1% level) or of output. Instead, support by project funding is only expressed in terms of number of projects.

The NRP refers to raising the tax deduction for R&D expenditures from 20% to 50% (Government Ordinance 8/2013), and does not mention that the lack of implementation norms made any tax deduction practically non-functional until March 2015. The reasons for the delay can only be subject to speculations, but a clear matter of dispute was the eligibility for deduction of the R&D expenditures made by the multinationals in foreign countries (a clause which was maintained in the adopted form).

Among the achievements, the NRP mentions the start of the project the Extreme Light Infrastructure – Nuclear Physics (ELI-NP) and also the elaboration of the White Paper meant to include a new pan-European research infrastructure financed by structural funds on the ESFRI roadmap – The Danube International Centre for Advanced Studies for River-Delta-Sea Systems (Danubius-RI, www.danubius-ri.eu).¹⁶

¹⁵ http://ec.europa.eu/europe2020/pdf/csr2014/nrp2014_romania_ro.pdf

For the following period (by June 2015), the NRP, which was released several months before the launch of the new RDI strategy, briefly mentions the following action lines: support for private R&D investment (without further details); IPR training for researchers and engineers (a dedicated project was launched in this direction); the continuation of the investment in human resources for RDI (probably by means of the structural funds for doctoral and post-doctoral schools); the concentration of national R&D institutes under MESR (achieved by Government Decision), the elaboration of a National Roadmap for RDI Infrastructure (still pending by March 2015), access to scientific literature for a broad spectrum of research organisations (achieved by means of the project ANELIS PLUS).

2.4 Policy developments related to Council Country Specific Recommendations

There were no Council Country Specific Recommendations for Romania related to R&I for 2013-2014.

2.5 Funding trends

2.5.1 Funding flows

The 1% target for public R&D expenditures set for the period 2007-2013 was de facto abandoned in 2009. Consequently, the National RDI Plan 2007-2013 received only a third of the programmed allocation. This situation resulted in the continuation of the brain-drain and adoption of stand-by strategies for the research organisations. The lack of predictability also affected the system in structural terms, e.g., the investment in research infrastructure has not been complemented by relevant resources for projects, while the large number of PhDs supported by SF did not find opportunities for a research career.

As mentioned above, NS 2014-2020 again set out the ambitious target of 1% public expenditures by 2020. However, the multiannual planning has already had a very poor start, as the estimated figure for 2014 (0.41% of GDP) proves to have been overestimated (more likely 0.3%, but final figure will be checked when Eurostat data are released). Moreover, the allocation for 2015 is 2.17 times lower than planned.

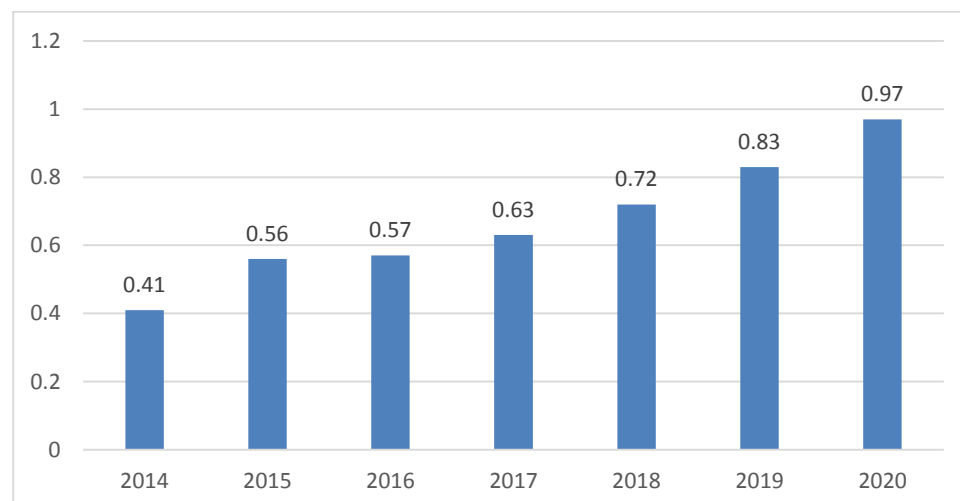
Previous experiences show that very often the multiannual commitments made with respect to the public budget are simply overlooked (this is also the case for educational or military expenditures).

The allocation of structural funds for R&D is surprisingly low when compared to the ambitious target of 1% public R&D expenditures. For the period 2007-2013 structural funds (SF) provided approx. 20% of public R&D expenditures. For the next programming period the sum allocated from SF has not been substantially increased despite the renewed target of 1% of GDP public expenditures, the commitment for ELI-NP, and the fact that the absorption rate for R&D structural funds is three times higher than the national average.

The €805m allocated from structural funds for 2007-2012 positions Romania somewhere in the middle in terms of prioritisation of R&D among East European countries: much less

than Poland (€4928m) or the Czech Republic (€2928m), but still considerably more than Bulgaria (€196m) and Hungary (€85m) (Data source: RIO elaboration on DG REGIO data).

Figure 2: Targets for public R&D expenditures (% GDP)



Data source: NS 2014-2020

Romania managed to attract €55m in EC contributions from FP6 and €144m from FP7 (Data source: RIO elaboration on DG REGIO data). These figures are relatively low when compared to other countries (e.g. €442m Poland, €294m Hungary, €289m the Czech Republic from FP7), but they are fairly close when considering these sums per number of researchers in the country.

BERD is even lower than public expenditures, reaching only 0.12% of GDP in 2013 (down from 0.19% in 2012). While this figure may be underestimated (mainly because companies are not stimulated to declare their R&D expenditures), the low base is related to the fact that the economy is dominated by multinationals, only few with R&D activities in Romania (see section 1.3), while the still young SME sector carries out predominantly low value-added activities.

The target for BERD included in the national RDI Strategy is 1% of GDP in 2020. This very high increase is expected to be leveraged both by the public expenditures and the 50% tax deduction.

In terms of R&D performers, it is not only business that has registered a decreasing trend (correlated probably with their R&D investment), but also higher education institutions (HEIs), which are most exposed to the limitations in project funding. In this respect, Romania is on a divergent trend compared to the EU average.

Table 1: Basic indicators for R&D investments

	2009	2010	2011	2012	2013	EU28 (2013)**
GDP growth rate	-7.1	-0.8	1.1	0.6	3.5 ^p	0.0
GERD (% of GDP)	0.46	0.45	0.49	0.48	0.39	2.02
GERD (euro per capita)	27.2	28.2	32.5(b)	32.1	27.9	539.2(e)
GBAORD - Total R&D appropriations (€ million)	0.74	0.71	0.68	0.6b	0.6b	1.41
R&D funded by Business Enterprise Sector (% of GDP)	0.19	0.17	0.18b	0.19	0.12	1.29
R&D funded by Private non-profit (% of GDP)	0	0	0b	0	0	0.02
R&D funded from abroad (% of GDP)	0.04	0.05	0.06(b)	0.07	0.06	0.2 (2012)
R&D performed by HEIs (% of GERD)	23.9%	24.4%	22.4%	20.8%	20.5%	22.8%
R&D performed by Government Sector (% of GERD)	34.8%	37.8%	40.8%	41.7%	48.7%	12.4%
R&D performed by Business Enterprise Sector (% of GERD)	41.3%	37.8%	36.7%	39.6%	30.8%	63.9%
Share of competitive funding for R&D in total R&D governmental funding ¹⁷	54%	56%	56%	54%	41%	
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	4.6	4.6	4.6	4.6	4.6	5.6
Employment in knowledge-intensive service sectors as share of total employment	19.8	19.9	20.6	20.3	20.1	39.2
Turnover from Innovation as % of total turnover		14.3				13.4 (EU27, 2010)

b = break in time series; e = estimated.

2.5.2 Project vs. institutional allocation of public funding

In 2013, 59% of public funding was allocated institutionally, increasing from approx. 45% in the period 2009-2012.

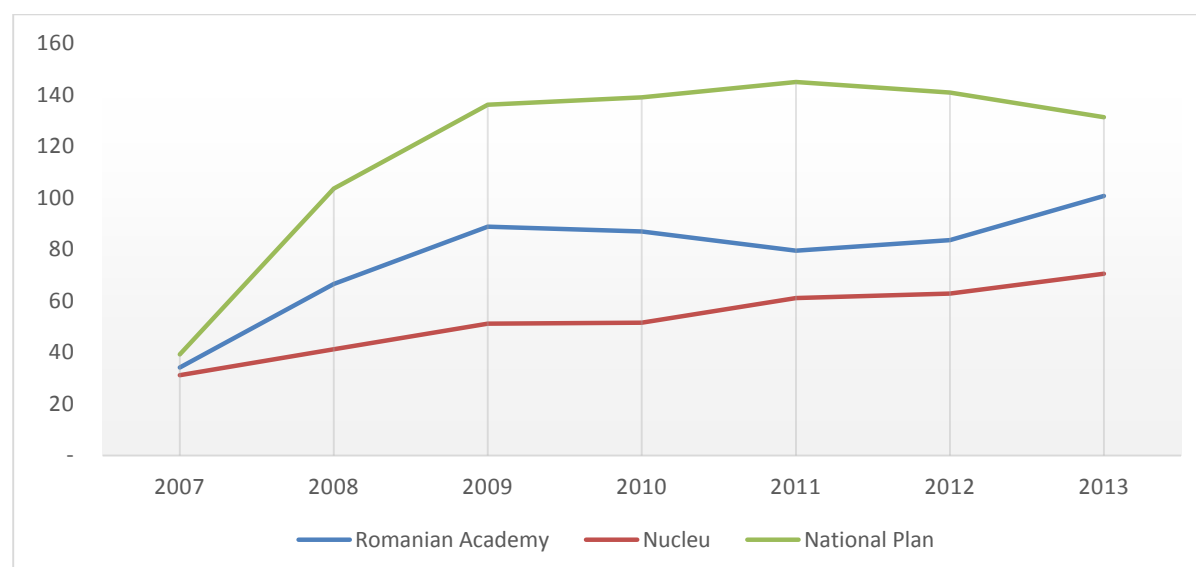
Institutional funding is directed towards:

- The programme of the Romanian Academy, having as recipients the institutes of the Romanian Academy. The allocation is highly proportional to the number of researchers (the full procedure is not available on the institution's website).
- The Nucleu programme, having as recipients the National R&D Institutes. Each institute has its own Nucleu programme (portfolio of projects), reflecting the specific R&D strategy of the institute, also including objectives related to the development of the economic sector/ branch corresponding to the institute's profile. The funding decision taken by MESR reflects a prioritisation of those specific Nucleu programmes, based on the joint analysis of the previous performance of the institutes and the relevance of their R&D portfolio in relation to the development

¹⁷ Based on own calculations, considering the Nucleu and Romanian Academy programmes as sources of institutional funding.

priorities of the corresponding sector/branch (the full procedure is not available on institution websites).

Figure 3: The annual allocation of R&D expenditures by main programmes financed from the national budget (m EUR)



Data source: Zulean et al, 2015.

Institutional evaluation is extensively discussed in Romania, but a coherent system with clear implications for competitive funding has not been adopted yet.

Hence, an evaluation procedure for the “entities part of the national RDI system” was adopted by Government Decision 1062/October 2011. The procedure was applied only to the national R&D institutes (32 in number), but the results are questionable in the sense that all institutes are included in the “A” category (which is further subdivided in A+, A, A-) and no institute was classified in the B, C or D categories. The implication of this classification for the funding instruments remains unclear. The detailed reports of the evaluation process are not publicly available.

The Romanian Academy uses a similar structure for the periodical evaluation of its institutes, but the results are not public. In what regards the universities, these do not receive institutional funding for RDI. However, R&D related indicators have been used as a proxy for the evaluation of the quality of teaching activities. The system based on “quality indicators” (i.e., 17 composite indicators referring to the teaching process, teaching staff, research etc.) was used as a wave for the universities’ per student base financing. While theoretically they could wave up to 30% of the financing, given the indicators’ large number and their rather contradictory influences, their real impact has been rather limited. (UEFISCDI, CNFIS 2013).

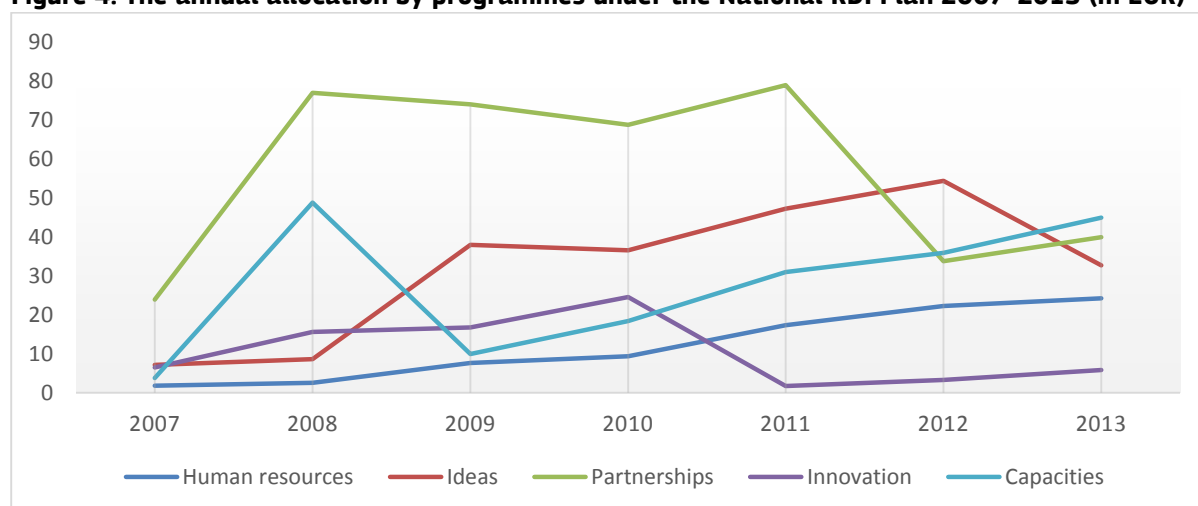
An alternative model based on “university classification and programme rankings” was implemented in 2011 and 2012, but it was contested by several universities, especially in what regards the lack of transparency (Hotnews 23 December 2013). The “university classification and programme rankings” were also not connected directly to R&D financing, but rather simply conditioned the right of universities to organise master and doctoral studies.

For the period 2014-2020, the institutional funding principles expressed in the NS attempt to correlate the criteria and amounts for funding going to national R&D institutes, Romanian Academy institutes, and universities. A dedicated programme for institutional funding was included in the draft National RDI Plan 2014-2020, which can de facto integrate the resources now spent through the Nucleu programme and add a similar stream for universities, in correlation with the financing stream of the Romanian Academy. The actual structure of the programme was not available by March 2015.

The main project-based funding programmes are:

- The National RDI Plan 2007-2013 (coordinated by UEFISCDI), a set of project-based funding schemes with a structure and procedures very similar to FP7 (i.e., the programmes Ideas, Human Resources, Partnerships, Innovation, Capacities), open to all RDI actors. International peer review is the standard for these calls. The budget cuts decided by MESR not only affected the pace of the calls, but also translated in further budgetary cuts to projects under way.
- The RDI axis of the Operational programme Competitiveness 2007-2013 (coordinated by MESR). As in the case of other structural funds, the level of bureaucracy is high for these programmes, resulting in a relatively large number of interrupted contracts. The programme managed to gain the interest of the initially reluctant business sector, but it is doubtful that the real entrepreneurs are the remaining clients. Unlike other financing lines from the structural funds, the RDI component exceeded the allocated budget (and not only because ELI-NP represents a large part). An evaluation of the programme is not available yet.

Figure 4: The annual allocation by programmes under the National RDI Plan 2007-2013 (m EUR)



Data source: UEFISCDI.

The budget for NP3 is not available yet. Regarding the structural funds for RDI, the following information is available:

- The Operational Programme *Competitiveness* – Priority axis 1. *RDI for competitiveness and business development* was allocated €798m from ERDF. The action lines associated to this axis are: (a) Enhancing research and innovation (R&I) infrastructure and capacities to develop R&I excellence, and promoting centres of

competence, in particular those of European interest; (b) Promoting business investment in R&I, developing links and synergies between enterprises, research and development centres and the higher education sector, in particular promoting investment in product and service development, technology transfer, social innovation, eco-innovation, public service applications, demand stimulation, networking, clusters and open innovation through smart specialisation, and supporting technological and applied research, pilot lines, early product validation actions, advanced manufacturing capabilities and first production, in particular in key enabling technologies and diffusion of general purpose technologies.¹⁸

- The *Regional Operational Programme* – Priority axis 1. *Technology transfer* was allocated €165m for the “creation, modernization and extending the innovation and tech transfer infrastructure, including equipment”¹⁹. The OP is coordinated by the Ministry of Regional Development and Public Administration.

2.5.3 R&I funding

An important source of indirect funding was introduced in 2010 with the R&D tax deduction of 20%, raised in 2013 to 50%. However, in the period 2010-2012 BERD further declined. Informal feedback from the private actors indicates that the 20% tax deduction has not been practical, both in bureaucratic terms and in its multiannual format of deductibility. The 50% introduced by law in 2013 stopped the 20% scheme *de facto*, as the new implementation norms have not been released yet. Starting March 2015, the 50% tax deduction can be implemented.

For the period 2007-2013, the National Plan and the Operational Programme for RDI structural funds had a large spectrum of instruments from basic research to market innovation. However, the National RDI Plan 2007-2013 received only a third of the programmed allocation.

For the period 2014-2020, the draft National RDI Plan (NP3) elaborated in 2013²⁰ has the following main project-based financing lines²¹, covering the spectrum from idea to market and from short to long term:

- “Frontier” – supports fundamental and exploratory research, with large involvement of PhD students,
- “Concept” – supports technology development up to the phase of laboratory tests;
- “Prototype” – supports prototype development for the technologies with commercialisation potential;
- “Solutions” – calls for projects with demand formulated in the public sector, the beneficiaries being involved in the selection of projects and the validation of results;

¹⁸ http://www.fonduri-ue.ro/res/filepicker_users/cd25a597fd-62/2014-2020/po/Prezentare.POC.2014-2020.pdf

¹⁹ http://www.fonduri-ue.ro/res/filepicker_users/cd25a597fd-62/2014-2020/po/Prezentare.POR.2014-2020.pdf

²⁰ www.cdi2020.ro; a modified version of NP3 has been elaborated; seemingly giving up the segmentation of project based funding in relation to the value chain phases.

²¹ The budget for the financing lines is not indicated. However, the draft plan states that the project financing is expected to represent 50-70% of PN3 funding.

- “Innovation contracts” – a kind of innovation vouchers;
- “Competence centres” – co-financing up to 50% of 5-7 year-long projects in public-private partnerships.

A recent set of interviews with managers of R&D institutes (Pascu and Voinescu 2014) shows that financial constraints appear to be the main obstacle to competitiveness.

2.6 Smart Specialisation (RIS3)

In Romania, instruments of smart specialisations and support are integrated in the national RDI Strategy 2014-2020. The Strategy together with the main implementation instruments (i.e., the National Plan for budgetary funds and the Operational Programme for SF) were developed in the same large foresight project (www.cdi2020.ro).

Four smart specialisations at national level were aggregated: (i) Bioeconomy; (ii) ITC, space and security; (iii) Energy, environment and climate change; (iv) Eco-nano technologies and advanced materials.

According to NS 2014-2020, smart specialisation is supported by a set of instruments which cover the entire spectrum of activities, from the idea to the market, such as: projects initiated by companies, competence centres and transfer infrastructure and innovation incubators.

Given the dispersed nature of PROs in Romania, the strategy foresees the creation of a proper legal framework, including clear and simple procedures, supporting the initiatives to merge public research organisations. At the same time, NS 2014-2020 supports actions for more correlated research infrastructure investments by means of an updated Roadmap and the concentration of the doctoral and post-doctoral topics financed by structural funds around the smart specialisation fields. However, the correlation with the Operational Programme for doctoral and post-doctoral study is not focused on these specialisations.

An important component of the smart specialisation process is the “strategic orientation mechanism”, whose purpose is to follow and analyse the creation of competences in the smart specialisation fields, and to periodically propose corrections and reorientations. The mechanism includes, among others, the National Registry of Researchers, the National Registry of Research Infrastructures, an Intellectual Capital Reporting for PROs, a Horizon scanning system. These components are already under development in two structural funds projects coordinated by UEFISCDI, and the actual integration into decision making process will be possible starting 2016.

The National RDI Strategy and the process behind it have undergone a S3 peer-review process in 3-4 July 2014 in Dublin.

All the 8 development regions in Romania are also required to prepare their RIS3 strategy, and this process, coordinated by the Agencies for Regional Development, is expected to be finalised by the end of 2015. Given that regional autonomy is quite limited in Romania, the main concrete actions resulting from these strategies will most likely focus on the allocation of RDI funds under the Regional Operational Programme (17% of RDI structural funds for the period 2014-2020).

2.7 Evaluations, consultations, foresight exercises

An integrated evaluation for the period 2007-2013 at programme level is difficult because for many programmes (e.g. Romanian Academy, Nucleu) the output-related information is not available, and the targets set in 2007 were correlated with a planned budget three times larger than the real allocation.

The system is also poor in information at institutional level. Hence, at organisational level, out of 41 public universities, 42 national institutes subordinated to MESR and 52 institutes of the Romanian Academy, on average approx. 2 out of 8 have publicly available annual reports for the period 2007-2013. (Zulean at all 2015, p52-53)

The new National Strategy for the period 2014-2020 sets out the creation of The Council for Statistics and Prognosis in Higher Education, Research, Development and Innovation, which would support an integrated evidence base on the performance of institutions and programmes.

The main foresight exercise was part of the elaboration of the NS 2014-2020 (www.cdi2020.ro) and envisaged the identification of thematic priorities at national level (i.e., smart specialisations and priorities of national interest). The foresight exercise used extensively data analytics technologies for the evaluation of the current situation, while the future-oriented evaluations were supported by 13 expert panels and over 4000 experts and stakeholders responding online. The main criterion for the final evaluation of smart specialisations was their economic relevance.

Most of the results of the foresight exercise for the elaboration of the National RDI Strategy 2014-2020 were integrated in the final Strategy document. Following a supplementary round of consultations with several national RDI institutes, several other fields were added to the final list of smart specialisations: a much larger stress on materials and especially nanomaterials, energy production (complementary to energy efficiency) and a larger spectrum of space and security subfields. As a result, four smart specialisations were aggregated: (i) Bioeconomy; (ii) ITC, space and security; (iii) Energy, environment and climate change; (iv) Eco-nano technologies and advanced materials. In addition, the so-called “national priorities” include: Health, Heritage and Cultural Identity, and New and Emerging Technologies (the latter being rather a framework for public procurement of innovation than a pre-determined set of technologies).

Romania does not have a macroeconomic model to assess R&I impact on economic growth.

3. National progress towards realisation of ERA

3.1 ERA priority 2: Optimal transnational co-operation and competition

The main transnational cooperation in which Romania is involved is related to the Extreme Light Infrastructure – Nuclear Physics (ELI-NP), a pan-European infrastructure which will be built in Romania using structural funds. In December 2012 the contract for the first stage of the investment (€180m) was signed. Access to the ELI-NP will be granted for most of the eligible time based on evaluation of the scientific cases by the international scientific board.

In addition to the construction of the laser, a 1 billion project for construction nearby of Măgurele Science Park is now high on the agenda. Măgurele Science Park (MSP) with the surface of 40 hectares is already part of Ilfov County Council's strategy for promoting entrepreneurship and developing the research, development and innovation²², but still needs clear internal political commitment and the approval of the European Commission for being financed via structural funds.

Other collaboration partnerships include (according to UEFISCDI 2014a):

- *The Swiss-Romanian cooperation programme 2011-2016*: Based on the agreement between the Romanian Government and the Swiss Federal Council of November 2010, the programme includes thematic research calls with a total value of €8.6m (85% Swiss contribution, 15% Romanian contribution) and doctoral and post-doctoral scholarships (total value €5.5m).
- *The framework for research collaboration between Romania and France*: Based on the agreement between the Ministry of National Education and the National Research Agency (France) in 2011, the framework supports joint research projects. 22 projects cumulating €5m were financed for the period 2011-2013.
- *The cooperation programme Romania-Norway, Iceland, Liechtenstein*, under the SEE Financial Mechanism 2009-2014, supports joint research projects (with a budget of €23.5m from the donor countries and 15% co-financing from the Romanian part, financed from the programme Partnerships). A number of 23 projects were financed in the areas of: Health and food safety; Social sciences and humanities; Environmental protection and management; and Renewable energy.

Romania also allocated approx. €1m per year in the period 2012-2014 for the participation in the transnational programme Ambient Assisted Living (AAL). In 2014, UEFISDI also hosted the 6th edition of the AAL Forum.

Romania contributes to 16 international organizations: International Centre for Genetic Engineering and Biotechnology (ICGEB, Trieste), International Seismological Centre (Newbury, UK), European Physical Society (Geneva), International Centre for S&T Information (Moscow), EUREKA, ESF (Strasbourg), COST, TERENA (Amsterdam), CEENET (Austria), EUROGEOSURVEYS, European Space Agency (ESA), ITER, GSI-FAIR GmbH, CERN, Unified Centre for Nuclear Research (Dubna) and SCAR. The contribution amounts to €25m per year, the largest contribution being to ESA (€16m) and CERN (€6m).

²² http://www.bursa.ro/s=companii_afaceri&articol=267362.html

For the period January 2013-September 2014, UEFISCDI supported 6 JTI Clean Sky projects (total €7.6m), 3 ENIAC projects (€0.9m), and one JTI FCH project (€40,000). (UEFISCDI 2014a)

For the programme EUREKA, 62 projects (approx. €11m) have been financed since 2008, out of which 10 in category CLUSTERS, 38 traditional and 14 EUROSTARS. (UEFISCDI 2014a)

For the period 2014-2020 the National Strategy provides for the following measures in support of internationalisation: supporting the participation in *Horizon 2020* projects; supporting the coordinated participation in European initiatives – Joint Programming Initiatives (JPIs), Joint Technology Initiatives (JTIs) / European Innovation Partnerships (EIPs) – and the cooperation with third parties (ERA-RUS, ERA-LAC); supporting the participation in international bodies (CERN, ESA, etc.) based on an integrated participation plan; funding bilateral calls; twinning and teaming projects; establishing ERA-like chairs to attract renowned researchers or university teaching staff. Most of these action lines need to be supported by the programmes of the National RDI Plan 2014-2020, which had not been adopted by March 2015. The realism of these measures needs also to be reconsidered given the cuts in the public R&D expenditures.

3.2 ERA priority 3: An open labour market for researchers. Facilitating mobility, supporting training and ensuring attractive careers

3.2.1 Introduction

“The underfinancing in the research and development affects the system in structural terms, resulting in a brain drain and decreased quality of human skills.” (European Commission 2015)

The Romanian research and innovation system is very small considering the country's population. The number of researchers (FTE) per population is four times below the EU average (27% in 2012, Eurostat data), and only 28% of these researchers were active in the business sector in 2013 (compared with 48% EU average in 2013, Eurostat).

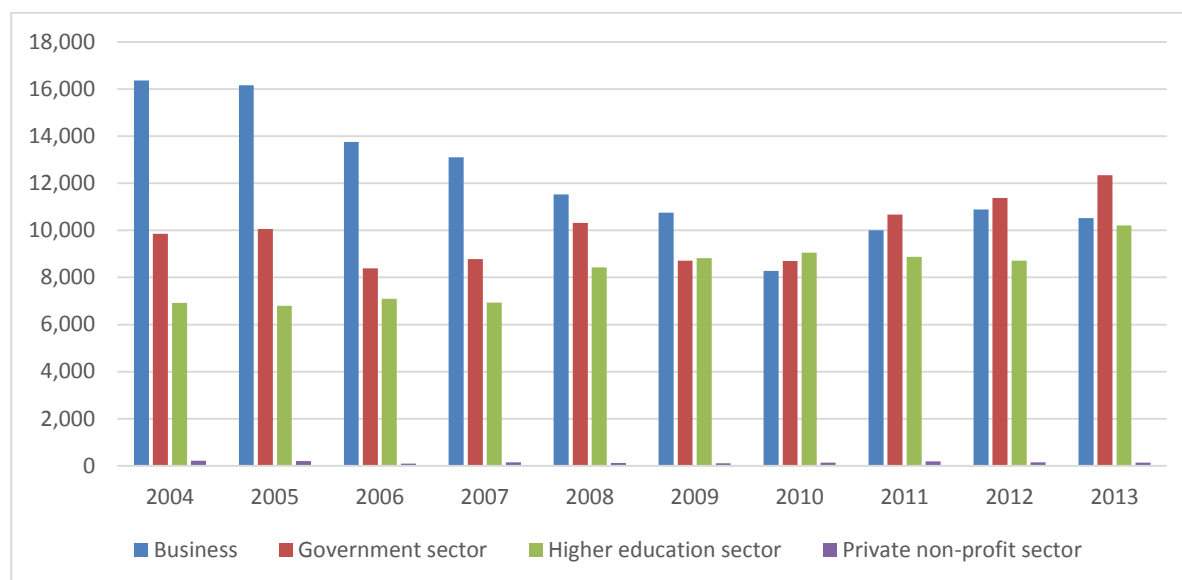
The National RDI Strategy 2007-2013 had, as one of its key objectives, reaching the EU average in researchers per population, but as the allocated budget was only one third of the programmed one, the objective was de facto abandoned. For the period 2014-2020 the new objective in terms of researchers is to double their number and simultaneously reach 45% in the business sector (i.e., the number of researchers in business should increase almost four times).

The supply of human resources in Romania exceeds the capacity of absorption by the traditionally underfinanced R&D system. Hence, Romania has, among EU countries, one of the largest scientific diasporas, with an estimated 15,000 active researchers working abroad (World Bank 2011, p.21). While the new doctoral schools (funded by Structural Funds (SF)) provided generous financial support for their students, the latter already experience difficulties in finding relevant jobs in Romania, becoming candidates for further enlarging the diaspora.

The inter-institutional mobility at national level is quite reduced in both institutes and universities. Very often, academic advance in their career in the university they graduated. This organisational culture in both institutes and universities makes recruitment often an internal affair, despite formal compliance with the steps of the procedure.

The career progression in the public R&D sector follows rigid regulations. The same rules could represent a barrier for the access of foreigners.

Figure 5: Number of R&D personnel by sector of performance



Data source: Eurostat.

For the period 2014-2020 the National Strategy sets out the following measures in relation to the “Labour market in research”: integrating doctoral students and young doctors in RDI projects; encouraging the attraction of researchers with advanced competences from abroad to be in charge of projects in a host institution in Romania; obligation for PROs to publish all vacancies in Euraxess and to adhere to the European Charter and Code for Researchers²³; introducing policies on the electronic identity of researchers for access to digital services for research. While the integration of PhD students in R&D projects is already encouraged under the existing National RDI Plan, and the attraction of researchers from abroad is supported by a dedicated financing line in the new cycle of SF, the rest of the measures still await implementation.

3.2.2 Open, transparent and merit-based recruitment of researchers

The Government Decision 286/2011 regarding the general principles of employment in the public sector allows for specific regulations by fields where such regulations are provided by the authorities coordinating public resources.

Article 15 of Law 319 /8.07.2003 *Status of research staff* stipulates that: vacancies for positions in research institutions are to be announced publicly including in a national

²³ See <http://ec.europa.eu/euraxess/index.cfm/rights/whatIsAResearcher>.

newspaper; the deadline for applications is set at a minimum of 30 days; the selection panels include research or university personnel from within or outside the institution with a scientific title equal or higher than the one required for the vacant job; the examination format is approved by the scientific council of the institution; the dossier of the candidate includes, among others, a list of publications and a copy of his or her 5 most representative publications.

More specific provisions for obtaining the scientific grades are given in the Order 4478 / 27.06.2011 of the Ministry of Education, Research and Youth (now, MESR). The Order provides for the specific criteria for the scientific titles in Mathematics and natural sciences, Engineering sciences and Biomedical sciences.

3.2.3 Access to and portability of grants

International access to grants, in the sense of the possibility of researchers affiliated to foreign institutions to apply for grants in Romania, is restricted. However, Romania has specific financing lines encouraging the candidacy of foreign researchers affiliated to Romanian institutions.

3.2.4 EURAXESS

The Euraxess Romania portal (www.euraxess.gov.ro) supports Romanian and foreign researchers in finding a job in Romania, provides information regarding the procedures for obtaining visas, residence and labour permits, provides information on taxation of research activities and the regime of intellectual property rights in Romania.

Given the low number of job vacancies in Romania's underfinanced R&D system, one could estimate that Euraxess is an important portal in the research labour market (see statistics below). The relatively large concentration of job vacancies (ten organizations cumulate 48% of job vacancies IN 2013-2014) seems correlated with the internationalisation activity of these organisations.

Table 2: Statistics of the use of euraxess.ro

	Number of organisations with minimum one job vacancy	Number of job vacancies	Number of unique viewers
2013	72	308	10150
2014	55	203	8076

Source: UEFICSDI.

3.2.5 Doctoral training

An analysis of the actual procedures of doctoral studies was carried out in 2011²⁴ showing a large diversity of practices. In the meantime, the doctoral studies are under new and more consistent regulation (Government Decision 681/2011²⁵). According to this GD, only some organizations have the right of organising doctoral studies, and these can be universities, university consortia, university-research institute partnerships and the Romanian Academy. These organisations can have one or more doctoral schools.

²⁴ <http://www.studii-doctorale.ro/diagnoza/pe-domenii-sectoriale-si-tematice.aspx>

²⁵ <http://www.legalis.ro/2011/08/05/codul-studiilor-universitare-de-doctorat-hg-6812011-nou/>

Regarding the list of universities which may organise doctoral studies, this is theoretically correlated with the classification of universities, i.e., in teaching, teaching and research, and research-intensive categories, with only the latter being allowed to organise PhD programmes. Given that the process of classification has been cancelled de facto, there are now unclear regulations in this respect.

In the period 2007-2013, 15,000 doctoral students were supported (i.e., scholarships granted through the doctoral schools) by the Programme Human Development of the Structural Funds (Romanian Government 2013).²⁶

The application of the principles of Innovative Doctoral Training is mentioned in the NS 2014-2020, but further implementation norms are required. In February 2015 the Ministry of Education and Scientific Research approved the methodology for the habilitation of PhD advisers.

3.2.6 HR strategy for researchers incorporating the Charter and Code

For the period 2014-2020 the National Strategy sets out the obligation of PROs to publish all vacancies in Euraxess and to adhere to the European Charter and Code for Researchers. Further implementation norms are required.

3.2.7 Education and training systems

The general government expenditure in education was 3.0% of GDP in 2012, the lowest in the EU with a negative impact on the quality of education, as proved among other by PISA surveys. According to the 2012 PISA survey, Romania was the second worst performer in the EU-28 in reading and science and the third worst performer in Mathematics (European Commission 2015).

The main challenges for the Romanian education system are: the *early school leaving* (17% in 2013 against 12% EU average) and *the quality and labour-market relevance of higher education*. In addition to the disconnect between higher education and the labour market, Romania is only now making efforts for reinforcing vocational education and training and apprenticeships schemes. These problems are currently reflected in the high number of young people who are not in education, employment or training (Youth unemployment reached 24 % in 2014, well above total unemployment level). (European Commission 2015)

The Romanian universities compete in the red ocean of high-income urban young student base. Hence, “rural, poor, and under-represented minority attainment in higher education are disproportionately lower than urban, higher income student attainment” and “Romania has currently the highest proportion of graduates in the social sciences in the EU. In 2008, 72% of students graduated with degrees in soft disciplines, with 58% of Romania’s graduates receiving degrees in the social sciences” (World Bank Group 2014).

To this situation contributes an overly regulated system, in which “[i]nstitutions have little autonomy to make decisions at the programmatic and degree-granting levels, mirroring their operations in government bureaucracy and providing little incentive for conforming to greater levels of accountability” (World Bank Group 2014), while “the funding model is not

²⁶ <http://www.fonduri-ue.ro/posdru/images/doc2014/rai2013.pdf>.

agile enough to provide incentives for modernization, efficiencies, innovation, or equity” (World Bank Group 2014).

The National Qualifications Framework was adopted in 2013 (Government Decision 918/2013). “The higher education national qualifications framework was completed, with 573 qualifications described in terms of outcomes, and was developed in line with the European Qualifications Framework for HE. This national tertiary education quality framework was intended to be integrated with the National Qualifications Framework, which was then under development” (World Bank Group 2014).

3.3 ERA priority 5: Optimal circulation and access to scientific knowledge

3.3.1 e-Infrastructures and researchers electronic identity

In the period 2006-2013, the academic community in Romania enjoyed access, free of charge, to important databases, both bibliographic and bibliometric, through several projects financed by the budget or EU funds, among which the ANELIS project (2009-2011), followed by the project ANCS-UEFISCDI (2012-2013). Since May 2013, the access to scientific literature has been provided through the publicly funded consortium ANELIS PLUS (UEFISCDI 2014d).²⁷

3.3.2 Open Access to publications and data

For the period 2006-2013, 5.3% of Romanian publications in scientific journals had green open access (compared with the EU average of 9.4%), and 9.5% had gold open access, which is above the EU average of 8.6% (Archambault et al 2014).

The National RDI Strategy 2014-2020 encourages the gold open access standard for publishing the results of publicly-financed research.

A National Strategy Regarding the Digital Agenda was adopted in June 2014. It sets out the regulation and facilitation of open data in Romania, including big data aspects.

²⁷ www.anelisplus.ro.

4. Innovation Union

4.1 Framework conditions

Except for the fluctuating RDI project co-financing under structural funds schemes and the National RDI Plan, the support for business R&D investment has been limited: the 50% tax deduction for R&D expenditures had no implementation norms until March 2015, while the more general access to credits for SMEs is very limited (including that for co-financing structural funds projects).

For the period 2014-2020, The National RDI Strategy sets out the following measures for the “Creation of a stimulating environment for the private sector initiative”: adopting the procedures for the 50% tax deduction; creation, within the *de minimis* aid programme, of an investment fund with starting capital and seed capital for entrepreneurs with innovative ideas, as well as of an investment fund with venture capital and growth capital for innovative start-ups; creation, within the *de minimis* aid scheme, of a credit system (micro-credit, credits for current capital, and credits for development investments) with interests subsidized in favour of innovative SMEs.; creation of an individual guarantee system to cover the technological risk in favour of innovative SMEs. For all these measures the implementation plan is not available yet.

4.2 Science-based entrepreneurship

There are only few cases of university spin-offs in Romania. The situation is not surprising considering the strong teaching orientation of Romanian universities.

Several Romanian technology projects have received financing using US crowdfunding platforms. In 2014 five such projects managed to raise thousands of dollars on kickstrater.com or indiegogo.com. The highest amount (\$95.000) was obtained from platform kickstarter.com for a "board game" developed by NSKN Games.²⁸

In recent years, the technology start-up movement has shown signs of awakening. Especially in the ITC field, several entrepreneurial hubs, clusters and accelerators have emerged, doubled by co-working innovation spaces.

The movement described above is featured so far only in significant urban agglomerations such as Bucharest, Cluj, Timisoara, Iasi or Brasov, but there is good potential for it spreading out throughout the country.

The “hubisation” movement led to several business plan competitions, acceleration and pitching sessions, mostly in the field of ITC/tech (e.g. How to Web, Innovation Labs or RICAP).

Similarly, the number of private sector sponsors of such events is steadily increasing, mainly as part of their CSR campaigns (Carrefour, Orange), but also as part of their internal innovation programmes (Microsoft, Intel, Cisco).

²⁸ <http://www.zf.ro/busi-ness-hi-tech/proiecte-romanesti-de-tehnologie-care-au-primit-finantare-pe-platforme-american-de-crowdfunding-in-2014-13742000>

4.3 Knowledge markets

The legal framework for the protection and sharing of intellectual property has been improved by the Law no. 8/2014 on service inventions, which was intended to clarify the rights of intellectual property revenue sharing between employees and their employers producing such inventions. The new law follows the complaints of the multinationals regarding the endless conflicts with their employees about IPR and, in this respect, the law increases the rights of the employer.

Romania ratified the Unitary Patent in February 2013. The Law 8/1996 regarding the authors' rights was updated in 2014.²⁹

The national patents have traditionally a very high proportion of physical persons as owners, a situation explainable both by the primarily reputational role of such patents and by the ambiguous IPR regime in Romania. However, the number of such patents has a clear descending trend, while the patents owned by universities and research institutes have increased in number. Unfortunately, the number of patents granted to companies decreased by a factor of three in the last decade. (ERAWATCH 2012).

Table 3: Number of national patents by main owners 2001-2012

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Physical persons	591	377	599	423	461	528	282	327	391	307	223	216
Companies	252	159	205	156	210	174	153	110	140	89	97	88
Research institutes	50	38	28	24	36	33	31	55	137	62	67	90
Universities	29	14	20	14	14	6	4	18	66	89	87	83
Other	71	31	13	13	11	9	8	5	12	8	17	9
TOTAL	993	619	865	630	732	750	478	515	746	555	491	486

Data source: OSIM (ERAWATCH 2012)

4.4 Knowledge transfer and open innovation

While the public innovation and tech transfer infrastructure is mostly outdated and limited in results, from the business sector there are signs of a healthy dynamics. For the new cycle of structural funds the challenge is that of connecting the financing to the real interests of business and of avoiding the formal clusters focused more on absorption of public funds than on building innovation-based competitiveness.

The public network for innovation and technological transfer (ReNITT)³⁰ has 45 accredited entities, out of which: 12 technology transfer centres, 12 centres for technological information, 15 technological and business incubators. Four scientific and technological parks complement ReNITT. The activities of these entities are still rather modest, but efforts are being made to enhance their institutional capacity by a project financed by

²⁹

http://www.euroavocatura.ro/legislatie/1137/Legea_drepturilor_de_autor_Actualizata_2014_Legea_8_1996

³⁰ The methodology for the accreditation of innovation and technology transfer infrastructure was adopted by Governmental Decision 406/ April 2003.

structural funds³¹ and through the introduction of the profession of “innovation manager” into the national classification of occupations (UEFISCDI 2012).

“An interview with an official of the National Authority for Scientific Research revealed that a survey they conducted among the 23 technology-transfer entities functioning on University campuses or within research institutes in Romania has identified the technology transfer activities within all these entities to be limited to non-inventive engineering services offered on a commercial basis to clients.” (Cioara et al 2013, p90).

Business enterprises as a funding source allocated in 2012 most of their resources to the business performers (approx. 69%), while governmental organisations account for 26% and HEIs for 5% (Eurostat data). This distribution reflects the weak linkages between private and public R&D organisations, as well as the poor collaboration with the universities.

For the period 2007-2013, the main inter-sectorial collaborations were supported by:

- The National RDI Plan 2007-2013 programmes *Partnerships* and *Innovation* (underfinanced starting 2011). As part of the programme Innovation, two new instruments were launched in 2012, namely: Support for high-tech export (which received 8 applications and has an estimated increase by a factor of 3.7 in high-tech export compared to the public contribution); Development of products, systems and technologies, having received 88 applications cumulating over €45m; and Vouchers for innovation (UEFISCDI 2012).
- The RDI Operational Programme, where most of the projects are based on inter-sectorial collaboration.

For the period 2014-2020 the same type of project financing is supplemented, among others, by:

- “Competence centres” (draft NP3), which are meant to support longer term collaboration between PROs and business; and by an inter-sectorial mobility programme.
- The tech transfer infrastructure supported by the Regional Operational Programme.
- Venture capital funds (NS 2014-2020).

The NS 2014-2020 sets targets in terms of activating the business sector and economic impact, following the Innovation Union Scoreboard indicators. The targets are very ambitious in comparison with the current situation, but for most of them the 2020 values are still considerably lower than the EU average.

³¹ With a budget of €4m, the project is financed under the Operational Programme “Developing Administrative Capacity (PO DCA), intervention field 1.2. Increase responsibility in public administration. The project site is <http://www.romaniainoveaza.ro/>

Table 4: National targets for RDI activating business and economic impact

	Last value (year)	Target 2017	Target 2020
Activating business			
BERD (% din PIB)	0,17 (2011)	0,6	1,0
Number of researchers in the business sector (FTE)	3518 (2011)	7000	14500
Public-private co-publication per 1 mil. Inhabitants	8,3	12	16
Innovative SMEs cooperating with others (%)	2,93	3,5	6
EPO patent applications / year	40	80	120
USTPO patent applications / year	17	30	60
Community trade mark applications / EUR 1 billion GDP adjusted to the purchasing power parity	2,14	3	4
Economic impact			
Innovative companies with rapid growth	-	50	150
SMEs introducing innovative products and services (%)	13,17 (2011)	16	20
Revenue from licences and patents from abroad as % of GDP	0,13 (2011)	0,15	0,17

Source: NS 2014-2020

However, the gap between business and PROs has a structural dimension, which is not expected to be resolved on short term: on one hand, the young Romanian SME sector is not innovation ready, while the consistently underfinanced public R&D sector is oriented towards career-promoting publication. Unfortunately, the structural gap is deepening, as the weight of high-tech exports decreased from a peak of 9.8% in 2010 to only 5.6% in 2013 (EU28 average is estimated at 15.3) (Eurostat).

4.5 Innovation framework for SMEs

Romania ranks 55th out of 143 countries in the Global Innovation Index 2014: better positioned in creative outputs (especially online, where it ranks 41), the country has problems in terms of investment (rank 120), trade and competition (rank 116) and innovation linkages (rank 108). **The Innovation Program (National RDI Plan 207-2013)** was launched in 2007 with a single instrument, DPD (Technologies and Product Development), covering all types of innovation resulting from research, the maximum financing being 80% of the budget for each project.

From 2012, three targeted funding instruments have been implemented: DPD, Stimulating high-tech exports and Innovation vouchers. Since 2012, private funding for *DPD* and *Stimulating high-tech exports* projects has risen to at least 50%, compared to 2007 when it was at least 20%. The third instrument, Innovation Vouchers, aims to solve specific problems for the research/development/innovation of the beneficiaries, problems which could not be solved internally but which, through the contribution of service providers, may generate innovative solutions that lead to the commercialisation of products, technologies or services developed by the beneficiary. The total budget for the period 2007-2013 was approx. €80m (523 projects). (UEFISCDI 2014c)

The commercialisation component is seen as a priority for the period 2014-2020. In this respect, the main instruments in the draft Operational Programme include: access to risk capital for SMEs, credits with subsidised interest rates, and guarantees for credits.

The main structural funds for RDI for the period 2014-2020 are connected to the OP Competitiveness 2014-2020 (Ministry of Economy 2014c), the Priority axis RDI. The guide for the following financing lines was open for public consultations: Innovation Clusters (Action 1.1.1 – Major R&D infrastructures), Innovative start-ups, R&D Investment departments of enterprises; RDI Projects for spin-offs and innovative start-ups; Projects for attracting staff with advanced skills from abroad.

The Governmental Strategy for the SME sector and business environment (Romanian Government 2014b) was adopted in 2014 (GD 859/2014). “In the view of the Romanian Government, building a viable entrepreneurial ecosystem nationwide by 2020 allows for the interconnected operation of productive enterprises, spread locally throughout the country, regionally or globally, with priority being given to chains with an increased potential of adding value, such as, for example, clusters and centres of excellence or industrial networks or services of high quality”. “The relevant statistical data show that about 57% of current microenterprises are subsistence enterprises, which enable a certain standard of living only for the business owners and their family”.

“Currently, there are a number of financial instruments for business from internal and external financing sources, but it is generally difficult for them to reach the SMEs. For example, various SMEs do not meet the eligibility conditions for European funds on projects, as they do not have the necessary funds to co-finance the project, their own obligatory participation of 15% of eligible expenditures, which can sometimes be a prohibitive amount”. “The government believes that an increase in the approximately 41.23% economically active SMEs in the next seven years is a realistic strategic objective”.

The action lines of this strategy include: supporting and promoting entrepreneurship; SME access to adequate funding; innovative SMEs, access to markets and internationalization of SMEs; and reactivity of public administration to the needs of SMEs. The action line innovative SMEs includes a very broad spectrum of measures, many of them overlapping with the National RDI Strategy (e.g., support for partnerships between SMEs and R&D institutes, or support for technological transfer) and it is not clear if there are additional resources for these lines or if there is an inter-institutional coordination mechanism for correlating their implementation.

Other lines (e.g., business consulting services for SMEs, support for integration into productive chains, support for clusters, awareness campaigns on IP protection and support for certification of new products) are complementary to the National RDI Strategy, but the key implementation programmes and the resources behind remain also unclear.

4.6 Venture capital markets

The venture capital (VC) market is underdeveloped in Romania. While there are 7 visible venture capital providers on the market³², in 2013 Romania registered only €3m in venture capital investment³³.

³² Advent International Romania (credits around \$5 millions), AIG New Europe Fund (credits around \$10m with a refund rate of 35 %), Global Finance International Ltd. (credits around \$2-3m to the companies with a turnover of minimum \$6m), Danube Fund offers credits between \$0.5-2ms, refund rate of 30%), Environmental Investment Partners offers (credits \$1-3m to the companies with minimum sales of \$0.8m and 3 years of activity, refund rate of 35%), ORESA Venture Romania (credits \$1m), and Romanian Investment Fund (Cyprus) LTD.

Both the supply and the demand of VC are still underdeveloped. On one hand, the “local culture does not favour serial entrepreneurs. Most of the people who start a company never consider selling it. Moreover, highly educated young people tend to prefer a position in a multinational corporation because it is being perceived as more secure”, “the entrepreneurs tend to overrate the value of their business” and “there is a lack of awareness related to the milestones that a company has to fulfil once it becomes part of a VC portfolio”. On the other hand, “a trend analysis would showcase that, rather than seeing more international funds scouting for deals in Romania, we observe more and more Romanian entrepreneurs raising early stage financing directly abroad, after they have relocated their business to Western Europe or North America”. (Cioara et al 2013)

An important law supporting business angels was adopted in April 2015: it sets, among others that income earned as dividends by individuals transferee for the shares acquired shall be exempt from tax for a period of 5 years. Also, the positive difference between the sale price and the purchase price resulting from the transfer of ownership of the shares obtained by the assignee is exempt from tax, if the transfer occurs after a period of 3 years from the acquisition. The range of investment is from 3,000 to 200,000 euro and most of the sectors are eligible (exceptions are: banking and financial services, real estate, steel industry, shipbuilding, military and consulting). The promoters of the law have estimated a number of 500 business angels’ investments for the first year after the adoption.³⁴

The risk capital fund *3TS Catalyst Romania* was launched via the initiative JEREMY of the European Investment Fund. It made in 2014 its first investments in technology-based companies.³⁵ Two other funds are announced for 2015 in support for risk investment of up to €1.5m per SME.³⁶

For the period 2014-2020, both the NS 2014-2020 and the SMEs Strategy provide for the creation, within the *de minimis* aid programme, of an investment fund with starting capital and seed capital for entrepreneurs with innovative ideas, as well as of an investment fund with venture capital and growth capital for innovative start-ups.

4.7 Innovative public procurement

The public procurement for innovation is not yet an established practice in Romania. Moreover, the corruption scandals associated with the public procurement process in general may restrain its applicability in the near future. The NS 2014-2020 has, as one of its key objectives, activating public sector demand (objective “*Innovative solutions for the public sector*”) with the following action lines: a programme for increasing the capacity of the public sector to formulate demand for innovation; a programme of thematic research on the researchers’ initiative, supported by the public institutions directly interested in the results; a programme for supporting public procurement of innovative products and services; a programme for pre-commercial public procurement and for monitoring new and emerging technologies; establishing a national target concerning the weight of public

³³ http://ec.europa.eu/enterprise/policies/finance/data/enterprise-finance-index/venture-capital/index_en.htm.

³⁴ <http://www.zf.ro/eveniment/pariul-antreprenorilor-care-au-lucrat-la-legea-business-angels-500-de-firme-vor-primi-finantare-intr-un-an-14253343>.

³⁵ <http://www.finantare.ro/initiativa-jeremie-patru-banci-vor-acorda-imm-urilor-credite-de-120-de-milioane-de-euro-cu-dobanda-reduca.html>.

³⁶ <http://www.startups.ro/analize/se-lanseaza-doua-noi-fonduri-de-capital-de-risc-pentru-imm-uri>.

procurement of innovative products and services within the aggregate public procurement; and a pilot programme for supporting social innovation. The implementation plans for the above mentioned action lines are still pending.

5. Performance of the National Research and Innovation System

5.1 Performance of the National Research and Innovation system

Romania has four times fewer researchers per population, a five times smaller GERD and 19 times smaller R&D expenditures in euro per capita compared to the EU average. From this perspective, the number of doctorate graduates, which is similar to EU average is simply a resource not used by the system. In terms of productivity, publication per researcher is better than the EU average, while patenting is almost absent.

In 2012, Romania produced 6.44 publications per 10,000 inhabitants on average, which is around the EU-28 average (13.8). International orientation is still quite low with 29.16% of publications internationally co-published. In 2012, Romania had about 177 international scientific co-publications per million population. In the period 2002-2012, a bit more than 5% of the Romanian scientific publications were in the top 10% most cited publications worldwide in comparison with 11% of top scientific publications produced in the EU28 (Science Metrix, 2014)³⁷. The share of public-private co-publications in Romania is 0.5% in the period 2008-2013 against 2.8% for the EU28³⁸.

³⁷ These publication data are based on Elsevier's Scopus database. ScienceMetrix, Analysis and Regular Update of Bibliometric Indicators, study conducted for DG RTD. They represent an update of the data displayed in the table below. See also http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=other-studies.

³⁸ SciVal 2014, Scopus based publication indicators derived from Elsevier's SciVal platform, www.scival.com last accessed December 2014.

Table 5: Assessment of the Performance of the National Research and Innovation System

1. ENABLERS	Year	RO	EU
Human resources			
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	2011	1.70	1.70
Percentage population aged 30-34 having completed tertiary education	2012	21.80	35.80
Open, excellent and attractive research systems			
International scientific co-publications per million population	2012	177.45	343.15
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	2009	3.50	10.95
Finance and support			
R&D expenditure in the public sector as % of GDP	2012	0.30	0.75
Venture capital (early stage, expansion and replacement) as % of GDP	2012	0.02	0.08
2. FIRM ACTIVITIES			
R&D expenditure in the business sector as % of GDP	2012	0.12	1.31
Linkages and entrepreneurship			
Public-private co-publications per million population	2011	8.33	52.84
Intellectual assets			
PCT patent applications per billion GDP (in PPSE)	2010	0.17	3.92
PCT patent applications in societal challenges per billion GDP (in PPSE) (climate change mitigation; health)	2010	0.04	0.85
3. OUTPUTS			
Economic effects			
Contribution of medium and high-tech product exports to trade balance	2012	0.38	1.27
Knowledge-intensive services exports as % total service exports	2011	45.22	45.26
License and patent revenues from abroad as % of GDP	2012	0.14	0.59

Source: European Commission, IUS Database (2014).

The number of ISI-indexed publications increased by 87% in the period 2007-2013, being correlated with the temporary improvement of project funding, the increasing importance of ISI publications for promotion in the academic career, and the emergence of Romanian ISI-indexed publications. The proportion of publications in the young Romanian ISI journals reached its peak in 2009 (44%) with a clear decreasing trend afterwards (32% in 2013).

Table 6: Number of journal articles with Romanian authors indexed in ISI-Web of Science during 2002-2013

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
ISI-indexed	2,417	2,506	2,667	2,985	3,568	4,907	6,482	7,653	8,506	8,064	8,444	9,197
out of which in Romanian journals	444	551	557	746	921	1,683	2,660	3,356	3,490	2,991	2,710	2,946
Percentage of papers published in RO ISI journals	18%	22%	21%	25%	26%	34%	41%	44%	41%	37%	32%	32%

Data source: InCites, retrieved April 2014.

The national patents have traditionally had a very high proportion of physical persons as owners, a situation explainable both by the primarily reputational role of such patents and by the ambiguous IPR regime in Romania. However, the number of such patents has a clear descending trend, while the patents owned by universities and research institutes improved. Unfortunately, the number of patents granted to companies decreased by a factor of three in the last decade. (ERAWATCH 2012).

Table 7: Number of national patents by main owners 2001-2012

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Physical Persons	591	377	599	423	461	528	282	327	391	307	223	216
Companies	252	159	205	156	210	174	153	110	140	89	97	88
Research institutes	50	38	28	24	36	33	31	55	137	62	67	90
Universities	29	14	20	14	14	6	4	18	66	89	87	83
Other	71	31	13	13	11	9	8	5	12	8	17	9
TOTAL	993	619	865	630	732	750	478	515	746	555	491	486

Data source: OSIM (ERAWATCH 2012).

5.2 Structural challenges of the national R&I system

The Romanian RDI system faces the following structural challenges:

1) *The RDI system is underfinanced.* The public R&D expenditures are not only very low but continuously at odds with the official targets. This discrepancy creates uncertainty (or false hope) for the different actors, crisis in the multiannual project financing and more generally supports unrealistic strategic planning. At the root of this political inconsistency may lay a limited pressure from the civil society, as the awareness regarding the role of innovation for wealth creation is still low.

2) *The business sector is not innovation ready.* The economy is dominated by multinationals, while the young SME sector carries predominantly low value-added activities. Activating the business demand for RDI is not only an innovation policy issue, but also needs to be seen in the context of a broader effort (e.g., by supporting entrepreneurship in general, or by access to credits for technology acquisitions) to support globalisation and the repositioning of Romanian companies in the value chains.

3) *The public RDI sector needs reorganisation.* The number of public institutes and centres is disproportionate to the number of researchers; the thematic orientation has limited interdisciplinary character and is not well correlated with the smart specialisations or the societal challenges. Research in the universities is financed almost exclusively by the intermittent project funding of the National Plan, or supported by the need for publication in view of advancing the academic career. In general, the public system is oriented towards publication and much less towards innovation. Very often the term “basic research” (which usually denotes remarkable outcomes) is used to mask the low relevance of results for business or the public sector.

3) *Dominance of supply-driven research.* The research carried in the public organisations supported by institutional funding is quite autarchic and with low relevance for business. At the same time, the public institutions are not able yet and do not have clear mechanisms to formulate specific calls for policy support or for public interest research.

5) *The innovation infrastructure (i.e., tech transfer centres, innovation incubators) is not mature.* The current innovation infrastructure is dispersed and captive to a naive linear mode of innovation. Romania needs real commercialisation skills and services for the innovation infrastructure to be able to support competitive business.

5.3 Meeting structural challenges

Table 8: Policy measures addressing structural challenges in Romania

Challenge	Current policy
<i>The RDI system underfinanced</i>	<p>The budgetary allocation of public R&D expenditures for 2015 is less than half of the value specified in the National RDI Strategy adopted only a few months earlier. Hence, a credible multiannual allocation is missing, maintaining the uncertainty in the system.</p> <p>The clarification of the 50% tax deduction for R&D expenditures may be a trigger for increasing BERD. However, additional efforts are necessary for a massive behavioural change in the business sector.</p>
<i>The business sector not innovation ready</i>	<p>The Competitiveness Strategy is not a consistent document with real action lines and budgets, a fact that reflects the low political commitment behind it. Similarly, the Export Strategy is more a diagnosis than a real strategy.</p> <p>The National RDI Strategy provides for a large spectrum of instruments oriented towards companies, but the actual financing remains problematic.</p> <p>Smart specialisations are only related to R&D policy and chances are it will remain limited unless inter-ministerial innovation governance is built.</p> <p>The tax deduction provided by the business angel's law is an important, yet isolated instrument in support for tech entrepreneurship.</p>
<i>The public RDI sector needs reorganisation</i>	<p>A vision-building process will be carried out in 2015. Political will is critical for both reorganisation and for a more competitive institutional funding. Also the chance of a positive change based on leadership is clearly correlated with the credibility of the existing chronic underfinancing.</p>
<i>Dominance of supply-driven research</i>	<p>The activation of public sector demand is set out under the National Strategy. Capacity building is necessary for well-articulated top-down calls and this also depends on real inter-ministerial collaboration.</p> <p>While envisaged by the national RDI strategy 2014-2020, competitive institutional funding needs a strong political commitment in order to become a reality.</p>
<i>Underdeveloped innovation infrastructure</i>	<p>The relevance of the innovation infrastructure is not connected with the proper financing of innovation activity.</p> <p>Romania needs to concentrate innovation infrastructures (one big facility per region) and to professionalise the personnel involved.</p> <p>Private innovation infrastructure should be encouraged and public support for clusters should focus on real economic potential.</p>

Source: Author's summary

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Annex 2 - Abbreviations

	Romanian	English
ABRDI	<i>Colegiului Consultativ pentru Cercetare, Dezvoltare si Inovare</i>	Advisory Board for Research, Development and Innovation
NCSR	<i>Consiliul National al Cercetarii Stiintifice</i>	National Council for Scientific Research
NCDI	<i>Consiliul National pentru Dezvoltare si Inovare</i>	National Council for Development and Innovation
CNFIS	Consiliul National de Finantare a Invatamentului Superior	National Council for Higher Education Funding
ELI-NP	-	Extreme Light Infrastructure – Nuclear Physics
IMF	Fondul Monetar International	International Monetary Fund
MESR	Ministerul Educatiei si Cercetarii Stiintifice	Ministry of Education and Scientific Research
NASRI	Autoritatea Nationala pentru Cercetare Stiintifica si Inovare	National Authority for Scientific Research and Innovation.
NIS	Institutul National de Statistica	National Institute of Statistics
NP3	Planul National de Cercetare, Dezvoltare si Inovare 2014-2020	National RDI Plan 2014-2020
NS 2014-2020	Strategia Nationala de Cercetare, Dezvoltare si Inovare 2014-2020	National Strategy for Research, Development and Innovation 2014-2020
OSIM	Oficiul de Stat pentru Inventii si Marci	The State Office for Inventions and Trademarks
RDI	Cercetare, dezvoltare, inovare	Research, Development and Innovation
SF	Fonduri structurale	Structural funds
UEFISCDI	Unitatea Executiva pentru Finantarea Invatamantului Superior, Cercetarii, Dezvoltarii si Inovarii	Executive Agency for Higher Education, Research, Development and Innovation Funding

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European Commission

EUR 27303 EN – Joint Research Centre – Institute for Prospective Technological Studies

Title: RIO Country Report Romania 2014

Author: Radu Gheorghiu

Luxembourg: Publications Office of the European Union

2015 – 46 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1831-9424 (online)

ISBN 978-92-79-48959-4 (PDF)

doi:10.2791/925233

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doi:10.2791/925233

ISBN 978-92-79-48959-4

